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**Topic**

Geometry

Key Question

How many different ways can you make the hexagon pattern block shape using smaller pattern blocks?

Learning Goals

Students will:

1. determine all of the ways to make the hexagon pattern block shape using smaller pattern blocks, and
2. make a record of those solutions.

Guiding Documents

Project 2061 Benchmark

- *Patterns can be made by putting different shapes together or taking them apart.*

*NCTM Standards 2000**

- *Investigate and predict the results of putting together and taking apart two- and three-dimensional shapes*
- *Describe attributes and parts of two- and three-dimensional shapes*
- *Recognize, name, build, draw, compare, and sort two- and three-dimensional shapes*
- *Build new mathematical knowledge through problem solving*

Math

Geometry

2-D shapes

Problem solving

Integrated Processes

Observing

Collecting and recording data

Comparing and contrasting

Problem-Solving Strategies

Use manipulatives

Guess and check

Materials

Pattern blocks

Student page

Crayons or colored pencils, optional

Background Information

Pattern blocks are a common manipulative in the primary classroom and can provide valuable opportunities for students to develop spatial skills and explore concepts of shape composition. In this activity, students will look at the hexagon pattern block and use their problem-solving skills to discover each way that this shape can be made using any combination of smaller pattern blocks.

This experience will help young learners to develop a deeper understanding of shape composition, and will also provide a setting in which they can practice their problem-solving skills and geometric vocabulary. Understanding that larger shapes are composed of combinations of smaller shapes is foundational to later learning about the properties and characteristics of shapes. For example, when young learners know that a hexagon can be composed of six equilateral triangles, it will be easier when they are older for them to understand why the interior angles of a hexagon all measure 120° .

Management

1. Students should work together in small groups of three or four. Each group will need a handful of pattern blocks with enough of each shape so that every student can work on finding solutions at the same time.
2. Even though the square and the tan rhombus pattern block pieces cannot be used to cover the hexagon, they should still be included so that students can recognize this fact.

Procedure

1. Have students get into groups and give each group a handful of pattern blocks.
2. Begin by going through each of the pattern block shapes and naming them. Discuss characteristics of each shape and how to identify them.
3. Have students find a hexagon pattern block and put it on the desk in front of them. Tell them that they are going to see how many different ways they can cover the hexagon using combinations of smaller pieces.
4. Be sure that students understand that the hexagon must be covered completely, without any holes or

any parts of pieces sticking over the edge. By having them cover the actual hexagon piece instead of placing the pieces into a hexagon outline, you provide students with the opportunity to gain a concrete, visual understanding of how the smaller pieces go together to make a hexagon.

5. After students become comfortable with the process of covering the hexagon completely, hand out the recording sheet. Challenge each group to record all of the different solutions that they can find in the spaces provided. Students can record their solutions by tracing around the pieces or by using a ruler to draw in the lines. If desired, students can color their solutions to correspond to the colors of the pieces.
6. Discuss how students solved the problem, and what solutions they found.

Connecting Learning

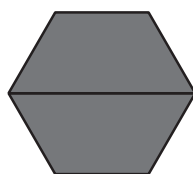
1. How many different ways are there to cover the hexagon using smaller shapes? [There are seven unique piece combinations that can be used to cover the hexagon, but your students may say that there are more if they consider two different arrangements or orientations of the same pieces to be different solutions.]
2. Which pattern block shapes can you use to cover the hexagon? [the triangle, the blue rhombus, and the trapezoid]
3. Which pattern block shapes cannot be used to cover the hexagon? [the square and the tan rhombus]
4. How many solutions use triangles? [5]
5. How many solutions use the blue rhombuses? [4]
6. How many solutions use trapezoids? [3]
7. How many solutions use one kind of shape? [3]
8. How many solutions use two kinds of shapes? [3]
9. How many solutions use three kinds of shapes? [1]
10. Can you find a solution that uses four kinds of shapes? [No] Why not? [Since the square and the tan rhombus cannot be used to cover a hexagon, there are only three shapes left besides the hexagon itself.]

Extension

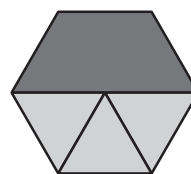
For those students who would like an extra challenge, you can develop other shapes for them to cover that have more possible solutions. (Try creating shapes that use the square and/or the tan rhombus.) Students can also be challenged to come up with their own shapes and find as many ways to cover them as possible.

Solutions

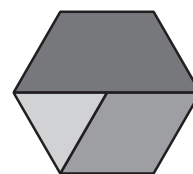
There are seven unique piece combinations that will make a hexagon, as shown below. The solution that uses two rhombuses and two triangles has two different arrangements, which are both given.



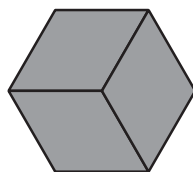
Two trapezoids



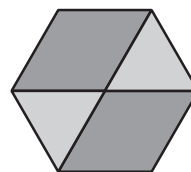
One trapezoid,
three triangles



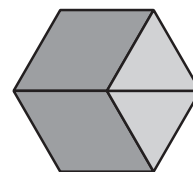
One trapezoid,
one rhombus,
one triangle



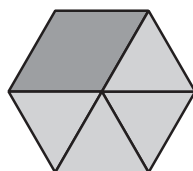
Three rhombuses



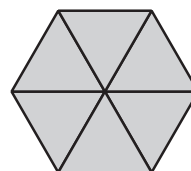
Two rhombuses,
two triangles



Two rhombuses,
two triangles



One rhombus,
four triangles



Six triangles

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Shifty Shapes



Record every solution you find by drawing it in one of the hexagons below.

